THE BELGIAN SALMONELLA SURVEILLANCE PROGRAMME 2005

Ann Daems[1]*, Nathalie Nollet[2], Katie Vermeersch[3], Yves Van der Stede[1], Paul Heylen[1]
*[1]Animal Health Care Flanders, Hagenbroeksesteenweg 167, 2500 Lier, Belgium, Ph: 32-3-4910356, Email: ann.daems@dgz.be; [2]Ghent University, Faculty of Veterinary Medicine, Department of Veterinary Public Health and Food Safety, Department of Reproduction, Obstetrics and Herd Health, Merelbeke, Belgium; [3]Federal Agency for the Safety of the Food Chain, DG Control Policy, Brussels, Belgium.

Abstract The Belgian *Salmonella* Surveillance Programme on pig farms, organized by the Federal Agency for the Safety of the Food Chain, started in January 2005. The programme is built up in several stages. In the first stage the 10 % farms with the highest seroprevalence (number of positive samples per farm) are identified. In the second stage, a follow-up programme is set up and implemented on these farms by the farm veterinarian and a specialist of the Animal Health Services.

Blood samples taken as part of the national Aujeszky programme from fattening pigs with different weight categories and age are analysed for the detection of *Salmonella*.

Serum samples from 50 randomly selected herds (N=50) were analysed for *Salmonella*-specific antibodies with an indirect ELISA (Idexx) and reported as s/p-ratio's. Results showed that 47, 39 and 28 herds were positive with a cut-off value of 0.25, 0.50 and 1.00 respectively. A herd was defined as positive when one animal tested positive.

The first results will determine the cut-off value to be used in the Belgian *Salmonella* Surveillance Programme.

Introduction Belgium is the third most important exporting country of pig meat in the world. With a production of 11 million fattening pigs a year, 50% accounts for domestic consumption and the remaining half is exported worldwide (FPS Economy – Statistics Division, 2004).
In 2003 the National Reference Centre for *Salmonella* and *Shigella* (NRSS) received 12.894 human *Salmonella* isolates (Table 1) of which *S. Enteritidis* and *S.* Typhimurium are the most prevalent serotypes.

Forty percent of all cases of human salmonellosis occurs in children younger than five years of age. During the summer (July until September) the NRSS counted more than 1.500 cases of human salmonellosis a month. From the end of the eighties until 1999 the number of cases of human salmonellosis in Belgium increased significantly and peaked in 1999 with a total number of 15.774 cases. This increase is mainly caused by the increase of *Salmonella Enteritidis*, mainly due to the consumption of fresh eggs. Nevertheless 20 % of all cases of human salmonellosis at this moment in Belgium are originating from pork (NRRS, 2003).

Food safety has been a high political priority during the last decade in Belgium and the rest of the world. Other European countries such as Denmark, The Netherlands and Germany also have *Salmonella* control programmes implemented. Since January 1st 2005, the Federal Agency for the Safety of the Food Chain has launched a *Salmonella* Surveillance Programme in pig herds based on serological screening on these herds. The present study describes the preliminary results of 50 randomly selected herds.

Serotype	Number	%
Enteritidis	9.201	71,4
Typhimurium	2.512	19,5
Virchow	152	1,2
Derby	100	0,8
Brandenburg	66	0,5
Hadar	60	0,5
4:I:-	59	0,5
Goldcoast	55	0,4
Infantis	54	0,4
Livingstone	43	0,3
Other	592	4,6
Total	12.894	100

Table 1: Salmonella from human origin. The most important serotypes in 2003.

Materials and Methods

1. The Belgian Salmonella Surveillance Programme

Blood samples taken on the farm from fattening pigs as part of the Aujeszky surveillance programme are examined for *Salmonella*-specific

antibodies. The number of blood samples taken on each farm is shown in Table 2. Every 3 to 4 months the sampling is repeated. An average herd has more than 120 fattening pigs. This makes the total number of analysed blood samples for *Salmonella*, 36 per year per herd.

Number of fattening pigs	Number of samples
1 to 3	1
4 to 6	2
7 to 9	3
10 to 12	4
13 to 15	5
16 to 18	6
19 to 21	7
22 to 24	8
25 to 30	9
31 to 120	10
> 120	12

Table 2: Number of blood samples for the monitoring of *Salmonella* for each herd.

The weight category of each sampled pig is reported. *Salmonella* antibody concentrations may increase during the fattening period (Kranker *et al.*, 2003). Table 3 shows the different weight categories in which blood samples are divided.

The *Salmonella* antibodies are detected with the HerdChek Swine *Salmonella* (HerdCheck Swine *Salmonella* Antibody Test Kit, Idexx Labaratories, Inc., Maine, USA). This ELISA enables detection of LPS-specific antibodies for the most common serogroups including B, C1 and D.
Results are reported as s/p-ratio's: S/P = (ODsample – ODneg control)/(ODpos control – ODneg control); OD = optical density. A sample is defined as positive if the s/p-ratio is equal to or higher than the cut-off value. According to the manufacturer, 3 different cut-off values are possible to use: 0.25, 0.50 and 1.00. The latter cut-off value is generally used in large-scale screenings, while the lowest cut-off value is the scientific cut-off value which can be used in a more stringent or progressed programme. For the surveillance programme, a final cut-off will be determined by the end of 2005, when all fattening and farrow-to-finish pig herds will have been monitored three times (a total of approximately 36 blood samples, depending on the number of fattening places in the unit.

2. Preliminary results

To evaluate the preliminary results of the first 3 months of the programme, 50 herds were randomly selected (using tables of random numbers). In total, 600 blood samples were analysed with a mean of 12 blood samples per herd. The results were evaluated descriptively.

Results The mean s/p-ratio of the 600 blood samples was 0.57 ± 0.8 (stdev) with a minimum of 0 and a maximum of 3.82.

In Table 5 the percentage of positive herds is shown for the three different cut-off values 0.25, 0.50, and 1.00. A herd is defined as positive if one blood sample tests positive.

Discussion During the first year the goal of the Belgian *Salmonella* Surveillance Programme is limited to monitoring. It makes farmers and veterinarians more conscious of the economic importance of *Salmonella* control, and especially of the consumer's demand for safe food. The Federal Agency for the Safety of the Food Chain and the Animal Health Services are negotiating to elaborate the programme.

Salmonella-specific antibodies are examined on the blood samples of the fattening pigs for the monitoring of Aujeszky's disease. Therefore the sampling needs to be representative for the total herd, taking age categories and different pens into account. The number of seropositive pigs per herd for *Salmonella* may increase during the fattening period (Kranker *et al.*, 2003; Nollet *et al.*, 2005). This implies that the current sampling method, where sometimes young pigs are sampled, may underestimate the number of seropositive pigs at the end of the fattening period. For this reason negotiations are being held to move the sampling of fattening pigs to the slaughterhouse in order to create a uniform group of animals (all the same weight category) being examined on *Salmonella* antibodies.

However, the results of the 50 randomly selected pig herds do not follow this trend. With a cut-off value of 1.00 only 15 % of the fattening pigs >= 80 kg tested positive. In contrast 31 % and 23 % of the fattening pigs of 60 to 79 kg and 40 to 59 kg respectively tested positive. This may be due to a very early infection in the fattening period because the antibody titres can start to drop two months after infection (Idexx Laboratories, 2002).

The object in the first year of the programme is to evaluate the prevalence of *Salmonella spp.* in fattening pigs on Belgian fattening and farrow-to-finish farms in order to classify herds into dif-

ferent levels and to determine the 10 % farms with the highest seroprevalence. The next step will be to set up and implement a reduction programme to improve the *Salmonella* prevalence in those herds. A bacteriological screening in order to identify the *Salmonella* serotype that causes the high number of seropositive pigs might be a useful tool.

For the moment no cut-off value is determined and the results will only be evaluated descriptively. As the program progresses, a cut-off value will be determined based on the results of the first year. In a second step, the herds will be classified in different categories based on the number of positive samples per herd. The aim is to lower the cut-off as the surveillance programme moves on and to become gradually more stringent.

In the framework of an official monitoring programme the Federal Agency of the Safety of the Food Chain is currently examining *Salmonella* on pig carcasses at the slaughterhouse by taking swabs. In 2003, 42 of 287 samples were positive. The most common serotypes were *Salmonella* Typhimurium, *Salmonella* Derby and *Salmonella* Brandenburg (The Federal Agency of the Safety of the Food Chain, 2003). For a good bacteriological screening on slaughterhouse level these examinations should be generalized and extended. A central database would be useful to compare the results of farm and slaughterhouse sampling as well as to follow up all *Salmonella* data and to implement logistic slaughter procedures in the future.

Conclusions Food safety, in particular *Salmonella* control, is an important issue in Belgium. Up until now Belgium is one of the few leading countries in Europe that is already monitoring *Salmonella* on pig farms before the execution of the new zoonoses legislation concerning the monitoring of zoonoses and zoonotic agents and the control of *Salmonella* and other specified food-borne zoonotic agents (Regulation 2160/2003 and Directive 2003/99/EG). The Belgian *Salmonella* Surveillance Program makes farmers and veterinarians more aware of the importance of microbiological food safety and the economic consequences for a pork exporting country. The Federal Agency for Safety of the Food Chain and the Animal Health Services are negotiating to move the blood sampling to the slaughterhouse in order to create a uniform group of animals being tested. Since 50% of the Belgian pork is produced for export, it is important for the future of the fattening pig sector that the latest evolutions on this hot topic are followed up.

References

Berends, B.R., van Knapen, F., Snidgers, J.M., Mossel, D.A., 1997. Identifications and quantifications of risk factors regarding *Salmonella spp.* in pork carcasses. *Int J Food Microbiol* 36: 199-206.

FPS Economy – Statistics, 2004, http://statbel.fgov.be.

IDEXX Scandinavia AB, Sweden, 2002

Kranker, S., Alban, L., Boes, J., Dahl, J., 2003. Longitudinal study of *Salmonella enterica* serotype Typhimurium infection in three Danish farrow-to-finish swine herds. *Journal of clinical microbiology*, June 2003: 2282-2288.

National Reference Centre for *Salmonella* and *Shigella*, Department of Bacteriology. Year report: *Salmonella* and *Shigella* spp isolated in Belgium in 2003: 7/44-8/44.

Nollet, N., Houf, K., Dewulf, J., Duchateau, L., De Zutter, L., de Kruif, A., Maes, D., 2005. The distribution of Salmonella strains in farrow-to-finish pig herds: a longitudinal study. *J Food Prot. accepted*.

Swanenburg, M., Berends, B.R., Urlings, H.A.P., Snijders, J.M.A., van Knapen, F., 2001. Epidemiological investigations into the sources of Salmonella contamination of pork. *Berliner und Münchener Tierärztliche Wochenschrift* 114: 356-359.

The Federal Agency of the Safety of the Food Chain. Activity report 2003: 119.

Age (weeks)	Weight (kg)
0 - 10	< 25
11 - 13	< 40
14 - 16	40 - 59
17 - 19	60 - 79
> 19	> = 80

Table 3: Weight and age categories of fattening pigs.

Descriptive results						# positive samples for a cut-off		
weight category	n*	Mean s/p-ratio	Min s/p-ratio	Max s/p-ratio	Standard deviation	0.25	0.50	1.00
>= 80 kg	179	0.50	0	2.41	1.29	102	54	27
60 - 70 kg	244	0.80	0	3.82	0.89	153	113	76
40 - 59 kg	160	0.69	0	2.95	0.87	82	57	38
< 40 kg	17	0.29	0	2.21	0.58	4	2	2
Total	600	0.57	0	3.82	0.80	341	226	143

Table 4: Descriptive results for the different weight categories and number of positive animals per category for three different cut-off values 0.25, 0.50 and 1.00. * n = number of blood samples from each category.

Cut-off value	% of positive herds (# positive herds/# herds sampled)
0.25	94% (47/50)
0.50	78% (39/50)
1.00	56% (28/50)

Table 5: Percentage of positive herds for three different cut-off values 0.25, 0.50 and 1.00.